

REMARKS

Applicant has thoroughly reviewed the outstanding Office Action, including the Examiner's remarks and the references cited therein. The following remarks are believed to be fully responsive to the Office Action and are believed to render the claims at issue patentable. Claims 1, 3-9, 13, 16-18, 20, 21, and 25-42 are pending in the present application.

Claim Amendments

Claims 17 and 18 have been amended to depend from claim 1.

Restriction

Applicants had provisionally elected these claims (Invention Group I) for prosecution. Affirmation of this election is by manner of this Response to the Office Action. Claims 23 and 24 (Invention Group II) are hereby expressly withdrawn from further consideration. Applicants expressly reserve the right to present the claims of Invention Group II, other species, or other claims, in this or a later filed divisional, continuation, or continuation-in-part applications. Therefore, claims 1, 3-9, 13, 16-18, 20, 21, and 25-42 are pending in the present application.

Rejections under Oomen, U.S. Patent No. 5,078,551

The Examiner has rejected claims 1, 3, 4, 9, 13, 17, 18, and 25 under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over, Oomen, U.S. Patent No. 5,078,551 (the '551 patent). Additionally, the Examiner has rejected claims 8, 16, 18, 26-30, 34-39, and 42 under 35 U.S.C. § 103(a) as being unpatentable over Oomen, U.S. Patent No. 5,078,551 (the '551 patent). The Examiner states that the '551 patent teaches at columns 1-2, a tool containing single crystal diamond with B implanted at the surface. Applicants respectfully traverse and request reconsideration of the Examiner's rejection.

To anticipate a claim, a reference must disclose each and every element of the claim. Lewmar Marine v. Variet Inc., 3 U.S.P.Q.2d 1766 (Fed. Cir. 1987). For an obviousness

rejection to be proper, the Examiner must meet the burden of establishing a prima facie case of obviousness. In re Fine, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988). Establishing a prima facie case of obviousness requires that all elements of the invention be disclosed in the prior art. In re Wilson, 165 U.S.P.Q. 494, 496 (C.C.P.A 1970).

Not every element of the presently claimed invention is taught by the '551 patent. Nor is the presently claimed invention rendered obvious by the '551 patent.

The '551 patent, at column 1, lines 35-67, describes a prior art "tool tip whose surface is doped with boron by means of ion implantation" wherein the "boron remains concentrated ... at the surface of the diamond so that a boron-doped layer of maximally $3\mu\text{m}$ is present." The '551 patent describes this tool as problematic because after resharpener the tool, the entire boron layer is ground off and must be reimplanted, resulting in a short useful life. Additional problems relating to the boron doped crystal diamond are described at column 1, lines 60-67. The '551 patent teaches that "the boron-containing surface layer contains mechanical stresses" and as a result "the diamond material is brittle so that small pieces of diamond chip off the tool tip during operation." In addition, at column 2, lines 8-35, the '551 patent describes a diamond tool wherein boron is "homogeneously dispersed" in the entire crystal.

The '551 patent does not teach each and every claimed limitation of the independent claims. For example, claim 1 and claim 28 require that the diamond crystal comprise a dopant element "having a greater concentration toward or near the crystal surface," and wherein the concentration of the dopant element is at a local minimum at least about $5\mu\text{m}$ below the surface. In contrast, the '551 patent only discloses diamonds having boron dopants that are either **homogeneously** distributed throughout the diamond or limited to a $3\mu\text{m}$ surface layer. There is no disclosure of a radially increasing concentration of dopant and a local minimum of the dopant at about $5\mu\text{m}$ below the surface. Rather, the '551 patent specifically discloses different dopant

configurations. The dopant concentration gradient as presently claimed in independent claim 1 is therefore not disclosed in the '551 patent.

In addition, the '551 patent does not teach a diamond crystal wherein the generation of "tangential compressive stresses" due to the dopant concentration which increases the "compressive fracture strength of the diamond" as presently claimed in claims 1, 26 and 28. Instead, in column 1, the '551 patent teaches a brittle diamond crystal. The '551 patent does not teach that a diamond crystal wherein generation of tangential compressive stresses increases the compressive fracture strength of the diamond as recited in each independent claim of the present invention.

The Examiner has rejected each of the independent claims 1, 26 and 28 as being obvious over the '551 patent. It is maintained that the presently claimed invention is not rendered obvious by the '551 patent, alone, or in combination with the other cited references. Rather, the '551 patent in fact teaches away from a synthetic diamond crystal comprising a dopant that is not homogeneously concentrated throughout the crystal. The '551 patent teaches various problems associated with a synthetic diamond crystal comprising a dopant layer at the surface of the crystal. These problems include a short useful life and a resulting brittle diamond material that chips off during operation. After detailing these problems, the '551 patent teaches a diamond tool wherein "boron is *homogeneously* dispersed in the diamond." Column 2, line 10. The '551 patent teaches that *homogeneously* dispersing the dopant in the diamond solves the problems exhibited in a synthetic diamond crystal comprising a dopant layer at the surface of the crystal.

The '551 teaches therefore away from a diamond crystal comprising dopant concentrated toward the surface of the crystal. Claim 26 requires that "dopant element is present in a concentration that causes the diamond lattice to expand toward or near an outermost surface of the crystal, thereby generating tangential compressive stresses at the surface of the crystal which

increase the compressive fracture strength of the diamond crystal.” Claims 1 and 28 require that a diamond crystal comprise at least one dopant element “being present in a concentration that is greater toward or near an outermost surface of the diamond crystal than in the center of the diamond crystal” “wherein the concentration of the dopant element causes the diamond lattice to expand toward or near the outermost surface” “increas[ing] the compressive fracture strength of the diamond crystal.”

The ‘551 patent does not teach or suggest the presently claimed diamond crystal, wherein the concentration of dopant increases with radius. Furthermore, the ‘551 patent does not teach or suggest a diamond crystal and a tool having a diamond crystal wherein the dopant concentration results in a diamond with increased “compressive fracture strength”.

Claim Rejections Under 35 U.S.C. § 103(a)

Claims 1, 3, 4, 7-9, 13, 16-18, 20, 21, and 25 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Mizuno et al., U.S. Patent No. 4,646,282 (the ‘282 patent) taken with Marchywka et al., U.S. Patent No. 5,587,210 (the ‘210 patent). The Examiner has indicated that the ‘282 patent teaches a 3 dimensional faceted diamond with Ar⁺ implanted. The Examiner has indicated that the ‘210 patent teaches ion-implanting diamonds, and teaches the claimed boron and nitrogen ions as equivalents to Ar ions.

The Applicants respectfully request reconsideration of the Examiner’s rejection. The combination of the ‘282 patent and the ‘210 patent does not render obvious the presently claimed invention. The combination of the ‘282 patent and the ‘210 patent does not teach “a three-dimensional faceted synthetic diamond crystal for use in a tool, the diamond crystal comprising at least one dopant element” wherein the dopant has “a greater concentration toward or near an outermost surface of the crystal than in the center of the crystal”.

By contrast, the '282 patent describes a stylus with a detecting electrode portion which is a thin layer of a conductive material deposited on a diamond. It is maintained that "a stylus with a detecting electrode portion" does not teach or render obvious a "three-dimensional faceted synthetic diamond crystal for use in a tool" wherein the dopant has "a greater concentration toward or near an outermost surface of the crystal than in the center of the crystal."

The '210 patent does not describe the presently claimed invention. The '210 patent describes a process for making diamond and diamond products which includes the step of implanting ions in a diamond substrate to form a damaged layer of non-diamond carbon below the top surface of the substrate. It is maintained that a "diamond substrate" as described in the '210 patent does not teach or render obvious a "three-dimensional faceted synthetic diamond crystal for use in a tool" having a "dopant element" "having a greater concentration toward or near an outermost surface of the crystal than in the center of the crystal."

The combination of the '282 and the '210 still does not arrive at the presently claimed invention. The combination of a stylus design and a method of making diamond by ion implanting does not render obvious the presently claimed diamond crystal, wherein the concentration of dopant increases with radius.

Claim Rejections Under 35 U.S.C. §103(a)

Claims 26-30, 33-42 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Mizuno et al., (the '282 patent) taken with Marchywka et al., (the '210 patent) as applied to claims 1, 3, 4, 7-9, 13, 16-18, 20, 21, 25 and further in view of Oomen (the '551 patent).

The Applicant respectfully request reconsideration of the Examiner's rejection.

As described above, the Applicants believe that the '551 patent teaches away from the presently claimed invention. The present rejection is directed toward independent claims 26 and 28. Both claims 26 and 28 recite a tool comprising diamond crystals which comprise at

least one dopant element wherein “the concentration of the dopant element causes the diamond lattice to expand toward or near the outermost surface” “increas[ing] the compressive fracture strength of the diamond crystal.”

The combination of the ‘282 patent, the ‘210 patent and the ‘551 patent does not arrive at the presently claimed invention. The ‘282 and ‘210 patents are silent as toward tool applications, specifically “strength of the diamond crystal.” The ‘551 patent’s description of a diamond tip doped with a boron layer in fact teaches away from the presently claimed invention. The motivation to use a dopant element in a “synthetic diamond crystal” wherein the concentration of the dopant “increase[s] the compressive fracture strength of the diamond” is found in the present application and is not found in the combination of the three references.

Claim Objections

The Examiner has objected to claims 17 and 18. Appropriate amendment to these claims has been made.

Dependent Claims

The Applicants have presented arguments directed toward independent claims 1, 26 and 28 in the above-identified rejections. As such, all pending independent and dependent claims have been addressed by the Applicants’ remarks.

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

In order to satisfy their duty of disclosure, the Applicants have herein submitted a Supplemental Information Disclosure Statement listing several references. The Applicants respectfully ask the Examiner to consider these references. The Applicants believe that the supplemental disclosed references are patentably distinct over the presently claimed invention.

None of the disclosed references describe a process that obtains a positive radial concentration gradient of a dopant element within a diamond lattice. The presently claimed invention is the only description that teaches a diamond crystal doped with an impurity element having a positive gradient concentration and a process of doping the crystal under HT/HP to achieve such gradient. The Applicants will address each reference listed in the Supplemental IDS in turn.

U.S. Patent Application Serial No. 10/262,784

U.S. Patent Application Serial No. 10/262,784, with inventor Meng, was filed on October 2, 2002. This application discloses a method for synthesizing boron doped diamond for improving the oxidation resistance of said diamond crystals which includes forming a fully dense mixture of graphite, catalyst/solvent metals, optional diamond seed crystals, and a source of boron. The 10/262,784 Application does not disclose or suggest how to process the diamond in order to achieve the presently claimed dopant concentration.

U.S. Patent No. 6,322,891

U.S. Patent No. 6,332,891 issued to Meng, et al., filed on April 28, 2000 describes a method for treating diamond for improving the oxidation resistance and the mechanical strength of said diamond crystals by forming a mixture of diamond crystals, a source of boron, and inert particles. At Column 3, lines 47-51, the '891 Patent teaches that the resulting "boron-diffused diamond product has boron present only in the top layer (or at the surface) of the diamond."

This disclosure therefore does not disclose or suggest the presently claimed concentration gradient.

U.S. Patent No. 6,527,854

U.S. Patent No. 6,527,854 issued to Prelas, et al. was filed on December 23, 1999. This patent teaches a low free energy method for more rapidly diffusing an impurity as exemplified by boron, into a natural or synthetic diamond or other crystalline element in powdered or granular form, without degradation of the crystalline structure. This patent teaches at Column 3, lines 26-30 that the fundamental crystalline structure is virtually unchanged by the diffusion of the impurity therein, such that mechanical, chemical, optical and electrical properties of the diamond crystalline are unchanged.

By contrast, the presently claimed invention teaches that the diamond crystal doped with an element having a positive concentration gradient leads to increased compressive fracture strength of the diamond. There is no motivation to use the process of the '854 Patent which discloses unchanged doped diamond crystals to arrive at the presently claimed strengthened diamond crystals.

CONCLUSION

In light of the above amendments and remarks, Applicants respectfully submit that all pending claims as currently presented are in condition for allowance and hereby request reconsideration. Applicants respectfully request the Examiner to consider the references disclosed in the Supplemental Information Disclosure Statement. Applicants respectfully request the Examiner to pass the case to issue at his earliest convenience.

Please note that this application has been assigned to Diamond Innovations, Inc. Our new docket number for this application is 128346.32311.

Respectfully submitted,
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